

Minerals Management Service
Arctic Nearshore Impact Monitoring In
the Development Area (ANIMIDA)
Program

Contract No. 1435-01-99-RP-30998

Minerals Management Service
Beaufort Information Update Meeting
Barrow, Alaska
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ANIMIDA - Background, Objectives, and Work Requirements

Environmental considerations of offshore developments in the Arctic require reliable information on:

- Baseline conditions
- Effects of construction
- Effects of exploration and operational discharges
 - ➡ Concentrations of contaminants/toxics and their associated environmental (ecological) risks
 - ➡ Concentrations of key source markers
- Effects of physical disruption

The ANIMIDA Program was initiated by MMS to address these considerations

ANIMIDA Phase I - Background, Objectives, and Work Requirements

The objectives of the ANIMIDA study are to monitor the impacts associated with the development activities of the Northstar and Liberty Units in the nearshore Beaufort Sea, the first State/Federal oil developments offshore in the Beaufort Sea

- The ANIMIDA study will be accomplished in two Phases
- **Phase 1:** Monitor key parameters that can result in impacts to the biota (1.5 years)
 - Review and summarize available information
 - Design a program based on testable hypotheses
 - Monitor key physical environmental parameters
 - **Sediment quality** - chemical sources and contaminants
 - **Resuspension of sediments** (potential impacts to water column and sensitive biological systems [e.g., the *Boulder Patch*])
 - **Noise and vibration** (potential impacts to marine mammals -- seals and Bowhead whales)
 - Test scientific hypotheses
 - Develop a program for Phase 2
 - Coordinate and communicate with stakeholders
 - Provide data

The objectives of the ANIMIDA study (continued)

- **Phase 2:** To build on the monitoring of key parameters used during Phase 1, and develop new monitoring strategies (4 years)
 - ➡ Review and summarize available information
 - ➡ Develop and design Phase 2 tasks based on testable hypotheses
 - ➡ Monitor key the specified environmental parameters, for example:
 - **Sediment quality** - chemical sources and contaminants
 - **Noise and vibration** (potential impacts to seals and Bowhead whales)
 - **Biota** - (marine mammals, fish, bivalves, invertebrates, the *boulder patch*)
 - **Resuspension of sediments** - (potential impacts to water column and sensitive biological systems [e.g., the *Boulder Patch*])
 - ➡ Test scientific hypotheses
 - ➡ Coordinate and communicate with stakeholders
 - ➡ Provide data and reports
 - ➡ Re-evaluate Phase II tasks and modify design as necessary (annually)

ANIMIDA Phase I - Background, Objectives, and Work Requirements

To accomplish the Phase 1 study objectives, a sequence of tasks are underway:

- Meeting with Science Review Board (SRB) and MMS - discussions with key stakeholders to define study direction, hypotheses to be proposed and tested, and the final study design and Study Plan (Task 1)
- Synthesis and summarization of what is known (Task 2)
- Implementation of the Study Plan consisting of logistics, sampling, analytical, and quality assurance/quality control (QA/QC) plans (Task 3)
- Analysis of collected samples for key organic, inorganic, auxiliary chemical, and biological, and acoustic parameters (Task 3)
- Reevaluation of the study design based on preliminary Phase I results - Draft Phase 2 Study Plan (Task 4)
- Management of the acquired data and development of database analysis tools to ensure delivery of all required data deliverables (Tasks 5 and 6)

ANIMIDA Phase I - Background, Objectives, and Work Requirements

To accomplish the Phase 1 study objectives, a sequence of tasks are underway (continued):

- Program management, testing of hypotheses using acquired data, data interpretation, and appropriate statistical tests by scientific experts (i.e., the proposed PIs) project reports, technical summary, and journal article (Tasks 7 and 8)

Program Management *Scientific Review Board*

The Scientific Review Board has been chosen to represent critical technical areas as well as knowledge of the Beaufort Sea environment and potential oil and gas E&P impacts

- *Arctic organic geochemist*
- *Bioacoustics*
- *Socioeconomics*
- *North Slope Borough biologist*
- *Industry Scientist*

Our overall Phase 1 design combines a focus on hypotheses testing, with a high-quality, integrated science program -- maximizing data collection, while minimizing risk.

- Open Water Program (Completed August - September 1999)
 - ➡ Site-specific radial monitoring design at Northstar and Liberty
 - ➡ Sediments, bivalves, amphipods, suspended sediments, current profiles and nephelometry, acoustics
 - ➡ BSMP locations, including Boulder Patch and reference locations
 - ➡ Contaminant source sampling
- Through-Ice Sampling (Scheduled for April 2000)
 - ➡ Selected subset of 1999 stations
 - ➡ Acoustics resampling/measurements
 - ➡ Suspended sediments at Liberty, Northstar, Boulder Patch, Reference
 - ➡ Ice cores - observations and subsampling
- Highly integrated, synoptic, using state-of the art scientific approaches

Scientific hypotheses form the backbone of the scientific approach. Preliminary topics for Phase 1 hypotheses that the Arthur D. Little Team is considering include:

- The concentrations of organic and metal pollutants in sediments after the development of the Liberty and Northstar Units
- Ecological risk posed by concentrations of organic and metal pollutants adjacent to Liberty and Northstar (i.e., compared to reference locations)
- Turbidity levels in the water column adjacent to Northstar construction activities
- Suspended sediments from construction, incorporated into the ice matrix, and Photosynthetically Available Radiation (PHAR) under the ice and at the seafloor in the Boulder Patch area in late Spring.
- The noise and vibration generated during the construction and development of the Liberty and Northstar Units and effects on local and migratory mammals (seals, whales)

Preliminary Phase 1 hypotheses that the Arthur D. Little Team is considering include: (continued)

- H8: The noise and vibration generated during the construction and development of the Liberty and Northstar Units are at levels that will have no adverse effects on local and migratory mammals (seals, whales) and bird species in the region

These hypotheses form the scientific framework for Phase 1 of the ANIMIDA study. They will be tested by means of applying a series of analytical tests and interpretive approaches on appropriate samples using a statistically valid approach.

ANIMIDA Phase II - Overview

ANIMIDA Phase 2 will build on the Phase 1 program and includes Core Tasks as well as development of new field and analytical Tasks.

Core Phase 2 - Task 1 components (Years 2, 3, 4, and 5)

- Task 9 - Knowledge Summary (literature synthesis)
- Task 10 - Logistics and Field Work
- Task 11 - Annual Technical Meetings
- Task 12 - Database Design and Analysis Tools
- Task 13 - Program Management
- Task 14 - Phase 2 Annual Reports, Final Report, Technical Summary and Journal Article(s)

ANIMIDA Phase II - Proposed Tasks

Specific ANIMIDA Phase II Tasks build on Phase I work . Several new monitoring Tasks are proposed for ANIMIDA Phase 2.

Proposed Phase 2 Monitoring Tasks may include:

- Task 2 - Organic and inorganic chemistry monitoring (Years 2 - 4)
- Task 3 - Acoustics and vibration measurements
- Task 4 - Monitoring contaminants in biota
- Task 5 - Physical oceanographic measurements
- Task 6 - Sources of suspended sediment loadings
- Task 7 - Sediment accumulation rates and sources
- Task 8 - Potential partitioning of contaminants - dissolved and particulate phases
- Task 9 - Cross Island whaling
- Task 10 - Monitoring the “Boulder Patch” area

Detailed draft study plans of the above tasks have been submitted to SRB and MMS

ANIMIDA Phase II - Proposed Tasks

Proposed ANIMIDA Phase 2 Tasks (Year 2) will be reviewed, finalized, and selected for release as part of the ANIMIDA Phase 2 RFP to qualified contractors.

The Phase 2 Task evaluation and selection process will involve:

- Review by MMS
- Evaluation during the Phase II Planning Workshop (October 1999)
- Review by the Scientific Review Board (SRB)
- MMS ANIMIDA budget allocation

The Task development and selection process will be repeated in Years 3 and 4 of the program to re-evaluate ongoing work and design new studies based on the information gained from completed Tasks.

Arctic Nearshore Impact Monitoring In the Development Area (ANIMIDA) Phase I

1999 Summer Field and Analytical Program

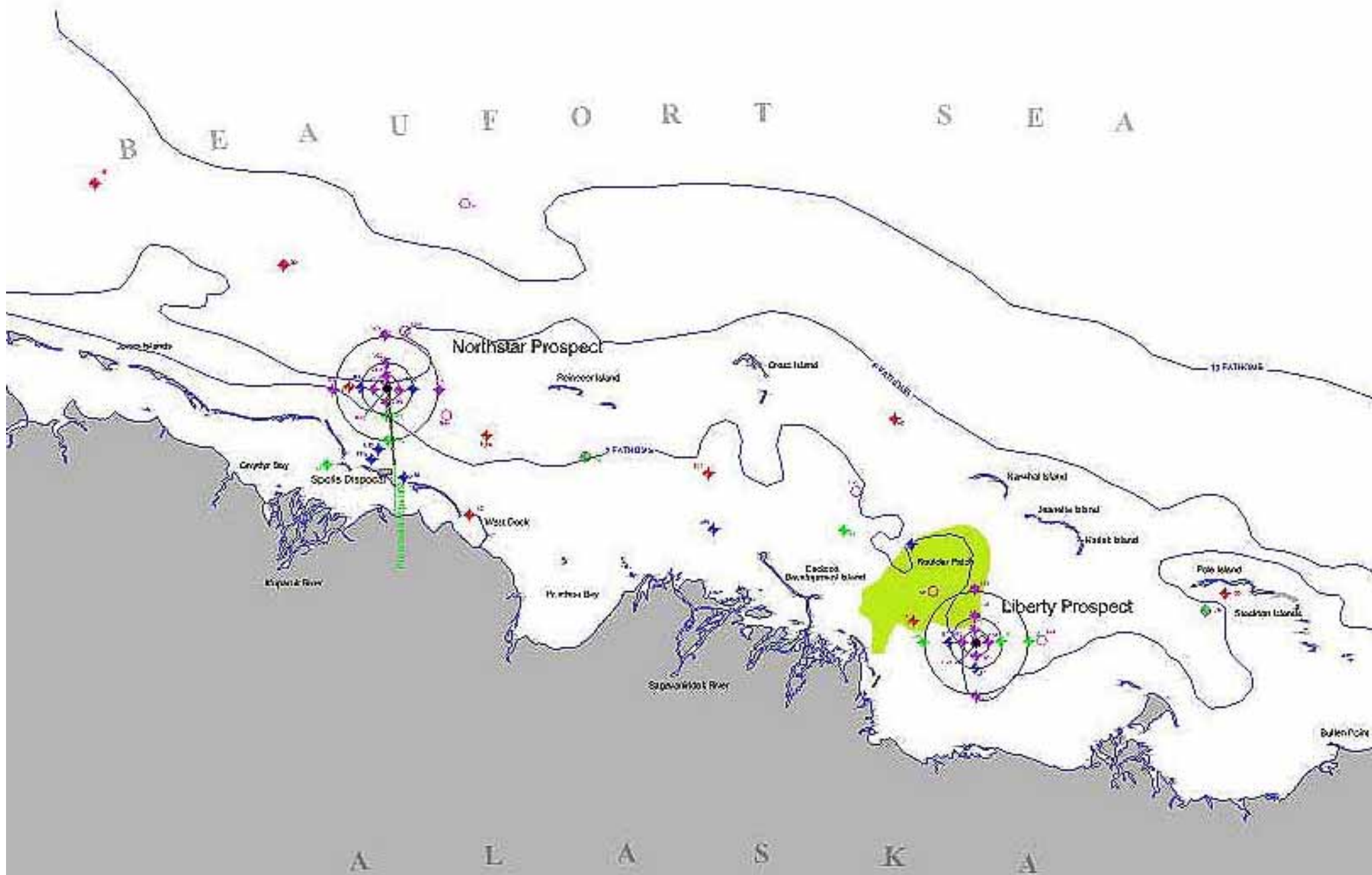
Phase I Field Sampling Activities

- Summer sampling program: August - September 1999
 - Sediment and biota chemistry
 - Sediment resuspension
 - Acoustic monitoring

- “Through-ice” sampling program: April 2000
 - Sediment resuspension
 - Acoustics monitoring
 - Photosynthetically active radiation

Sampling Program Design Provides Regional Coverage, Site-Specific Coverage and Statistical Replication; and also Ensures Coupling of Chemical, Sediment Transport, and Acoustic Measurements.

- Incorporates a combination of historical **Beaufort Sea Monitoring Program (BSMP)** stations
- **New Site specific stations** for sediment sampling are located along four radial transects away from Northstar and Liberty prospects (sources), and stations along the proposed Northstar pipeline route and in the “boulder patch”
- Utilizes a combination of **BSMP stations** and **site specific stations** for sediment resuspension, and **new stations** (radial transects - as necessary) for acoustics
- Design allows a comparison of radial stations along a gradient away from sources
- **Source samples** collected for sediment chemistry and resuspension from local river sources (and Northstar and Liberty Islands - winter)



During August 10 through September 5, 1999 the ANIMIDA Phase I summer field sampling Survey successfully completed

- Collected samples at 40 stations
 - ➡ 15 historic BSMP stations
 - ➡ 12 Northstar stations (4 stations each on 1 km, 2 km, and 4 km radials)
 - ➡ 13 Liberty stations (4 stations each on 1 km, 2 km, and 4 km radials)
 - ➡ 3 Northstar Pipeline route stations
- Collected 47 surface sediment samples (0-1 cm) for chemistry
 - ➡ triplicates at two stations
- Collected 10 bivalve/amphipod samples
- Collected 8 source sediment/peat samples (4 river stations, causeways)
- Total: 63 sediment chemistry samples

ANIMIDA Phase I summer field sampling Survey (continued)

- Collected current and turbidity profiles at 11 stations (13 total profiles)
- Collected 40 suspended sediment samples
 - ➡ 11 stations (corresponding to current and turbidity profile stations)
- Total: 40 suspended sediment samples (36 proposed)
- Collected acoustic measurements along 4 radials
 - ➡ 2 radials from Northstar (NNE and ESE)
 - ➡ 2 radials from Liberty (NNW and E)
- Total 10 acoustic stations

A full range of sampling activities were conducted from the MMS Launch 1273 during the Summer field program:

- Van-veen grab sampling for sediment collection
- Doppler current profiler and profiling nephelometer (sediment resuspension)
- Hydrophones (3 depths) and ceramic microphone (acoustics and vibration measurements)
- Grab sampling and sieving sediment for bivalve collection
- Amphipod traps (*Annonyx* amphipod collection)
- Niskin bottles for water sampling (sediment resuspension)
- Deployment of current meters (UAF - CMI)

The “through-ice” sampling design builds on the spatial coverage of the 1999 summer field program.

- Sample 8 stations: re-occupy selected summer 1999 stations at Liberty, Northstar, Boulder Patch, and reference sites for suspended sediments
- Collect 24 suspended sediment samples
 - ➡ 8 stations x 3 depths
 - ➡ TOC, TSS, NTU
 - ➡ Trace metals and carbon isotopes on a subset of samples
- Collect 24 ice core sections for analysis
 - ➡ 8 stations x ~ 3 core sections per station
 - ➡ Trace metals, TOC, carbon isotopes
- Total: 24 suspended sediment samples
- Total: 24 ice core section sediment samples
- Total of 10 acoustic stations (re-sampling summer 1999 stations)
- Total of 8 PHAR measurement stations (at suspended sediment sites)

Laboratory analyses are based on state-of-the-art and published approaches previously used in MMS studies in Alaska.

- Organic Analysis (bottom sediments and biota)
 - ➡ Polynuclear aromatic hydrocarbons (PAHs) (extended PAH list)
 - ➡ Saturated hydrocarbons (SHC) – alkanes (nC10 - nC40) and isoalkanes
 - ➡ Biomarkers (steranes and triterpanes) on selected samples
- Inorganic Analysis (bottom sediments, biota, and suspended sediments)
 - ➡ Trace and major elements
 - ➡ Methyl mercury (selected samples)
- Total Organic Carbon (TOC) - bottom and suspended sediments
- Sediment grain size - bottom sediments only
- Carbon isotopes in bottom sediments and suspended sediments
- Total suspended solids (TSS) and turbidity (NTU) - suspended sediments only
- These analyses include all historical BSMP target analytes as well as additional diagnostic analytes

Analytical Methods:

- Organics
 - ➡ Trace level analysis for PAH and SHC using large sample size (approximately 50 g for sediments, 15 g for tissues)
 - ➡ Analysis of SHC by gas chromatography/flame ionization detection (GC/FID) for sediments and tissues
 - ➡ Analysis of PAHs by GC/MS in the selective ion monitoring mode (SIM) for sediments and tissues
- Inorganics
 - ➡ Trace level analysis of sediments and tissues for metals by a combination of:
 - ➡ FAAS, CVAAS
 - ➡ GFAAS
 - ➡ ICP/MS
- TOC analyses by CNS analyzer, and grain size by sieve analysis
- Carbon isotope analysis by isotope mass spectrometer

Quality Assurance/Quality Control, Laboratory Intercalibrations

- Use of clean techniques during sampling, oversampling, and collection of field, equipment, and trip blanks in the field
- Full suite of blanks, matrix spikes, and standard reference materials (SRMs) for organic and inorganic analyses
- Participation in NOAA/NIST intercalibration exercise for organics and comparable exercise for inorganics

Adherence to data quality objectives (DQOs), as established in laboratory QA Plan, will enable full performance and acceptability of data to be measured.

MMS Vessel 1273

Beaufort Sea, August 1999

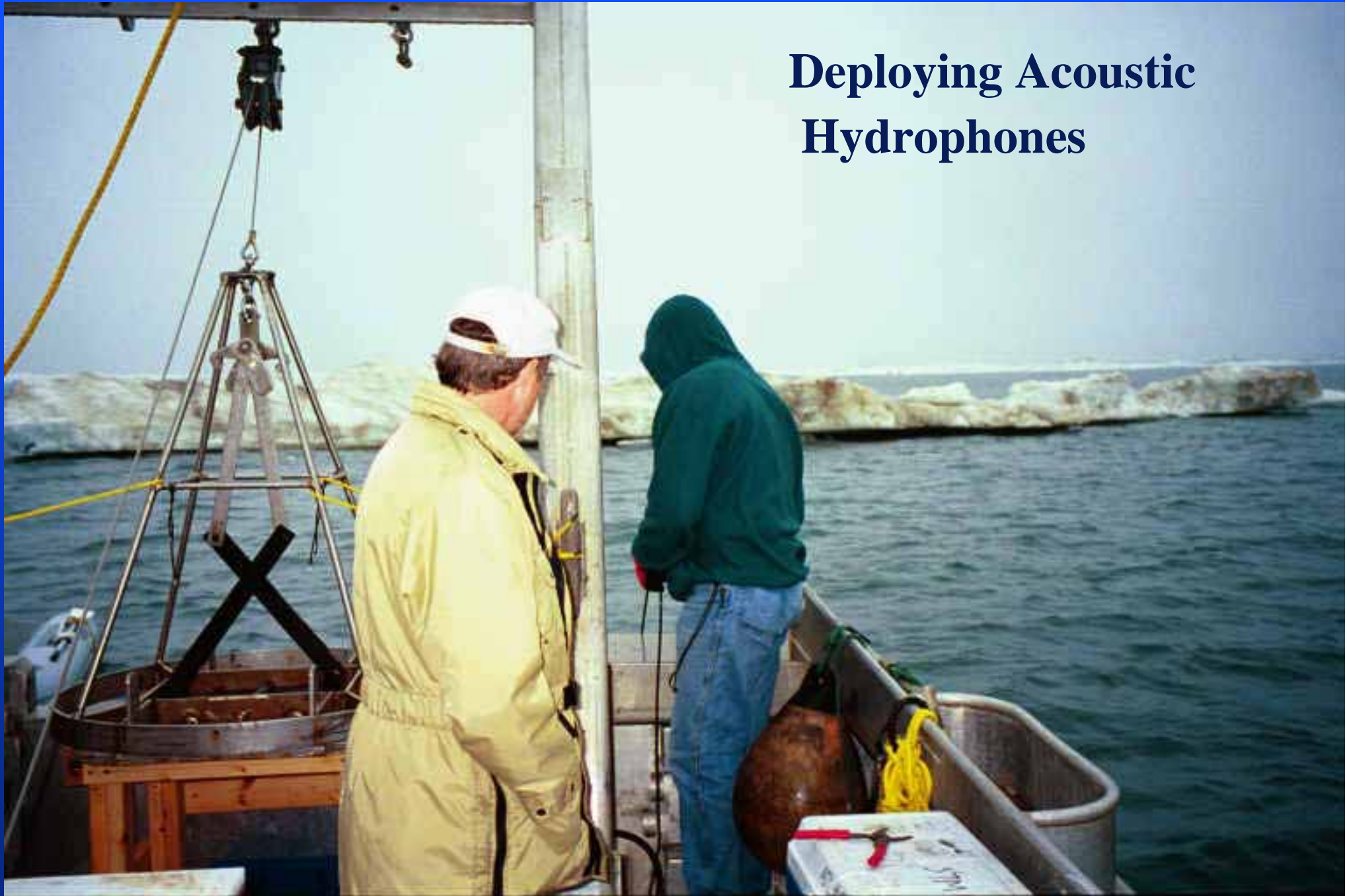


MMS Vessel 1273

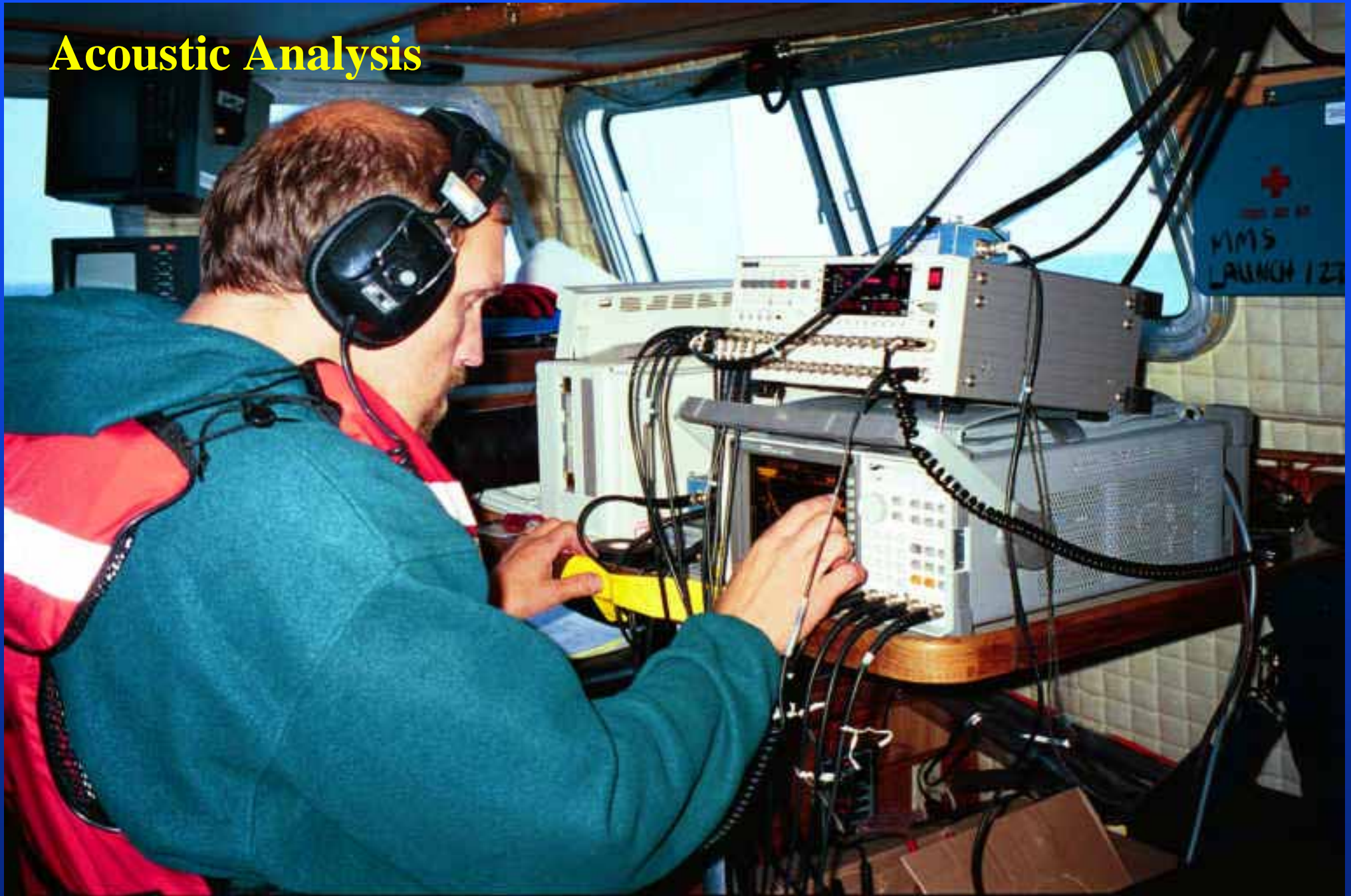
Beaufort Sea, August 1999



Deploying Acoustic Hydrophones



Acoustic Analysis



Arthur D Little

Van Veen Grab for Sediments





Bottom Sediment

Dr. Mud

MMS *R/V 1273*

Beaufort Sea

August 1999

Arthur D Little

Suspended Sediment Sampling





Aanderaa Turbidity Probe with CTD



Sieving for Clams



Astarte sp. Clams





Isopods

Baiting Amphipod Traps



Deploying Amphipod Traps



August 1999 Colville River Sampling



Coleville River Peat

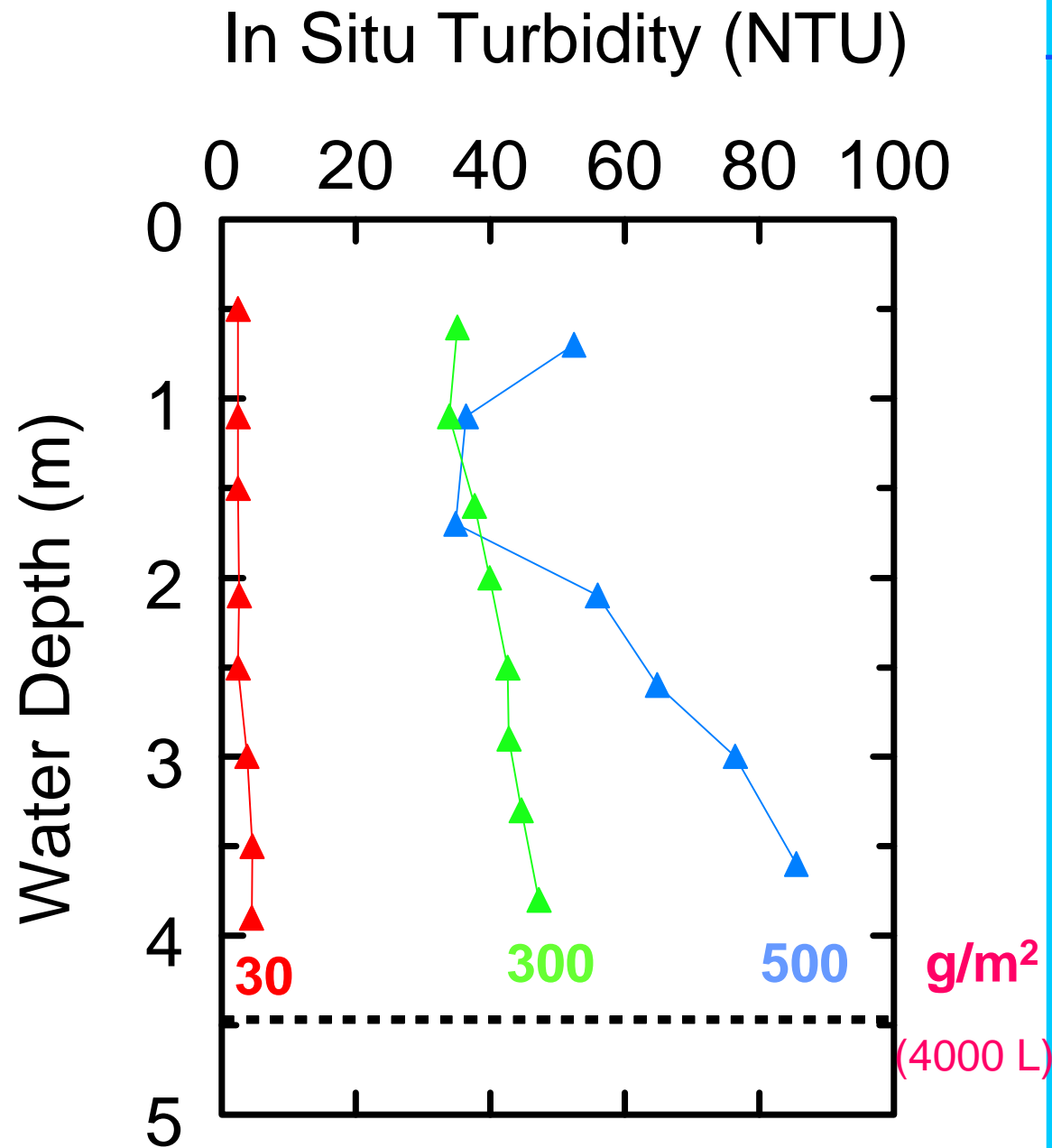


Data analysis from the summer 1999 field program is now complete.

- Organic and metals chemistry analyses are complete - data are being compiled in the project database
- Preliminary acoustics interpretation has been performed
- Preliminary, preliminary, preliminary..... results for metals and organics parameters appear to be within the range of those for previous studies (BSMP)

Data reporting and the Phase I Project Report are on schedule - Completion after incorporation of April “through ice” field sample collection and analysis

N13



Calm, Pre-Storm

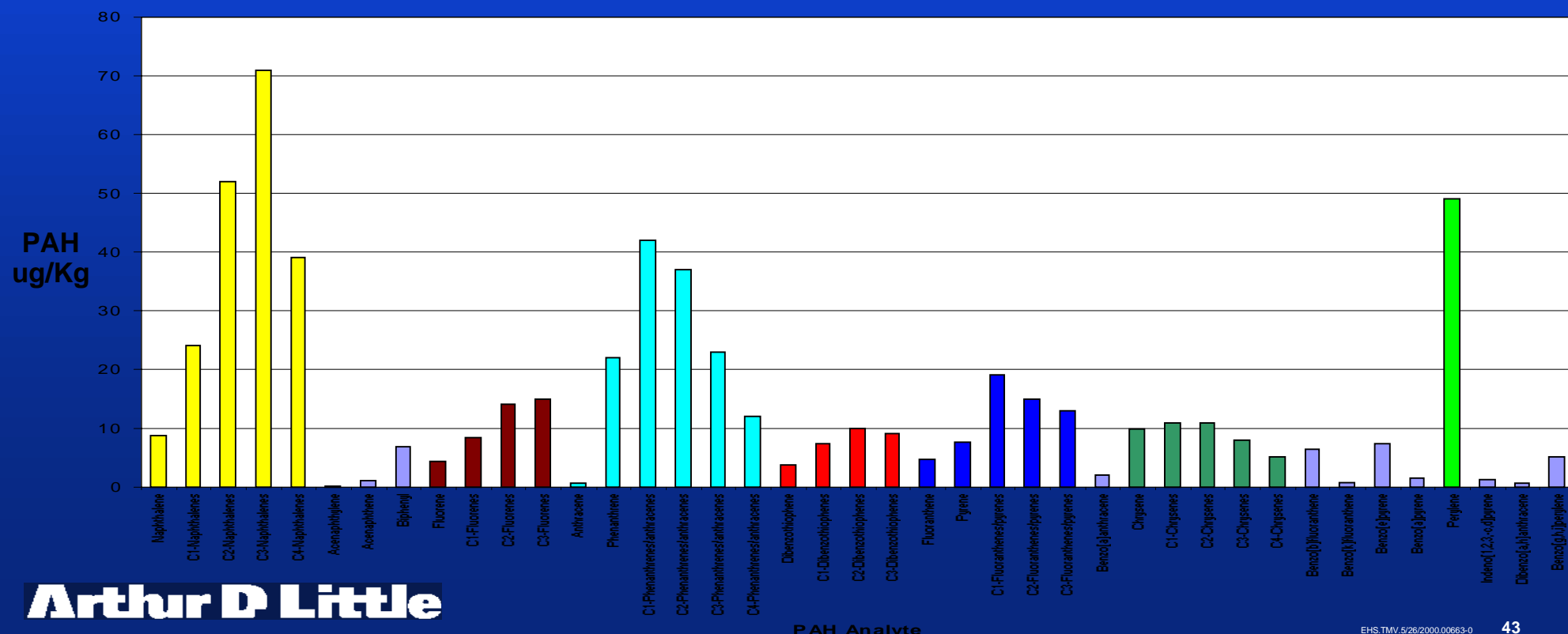
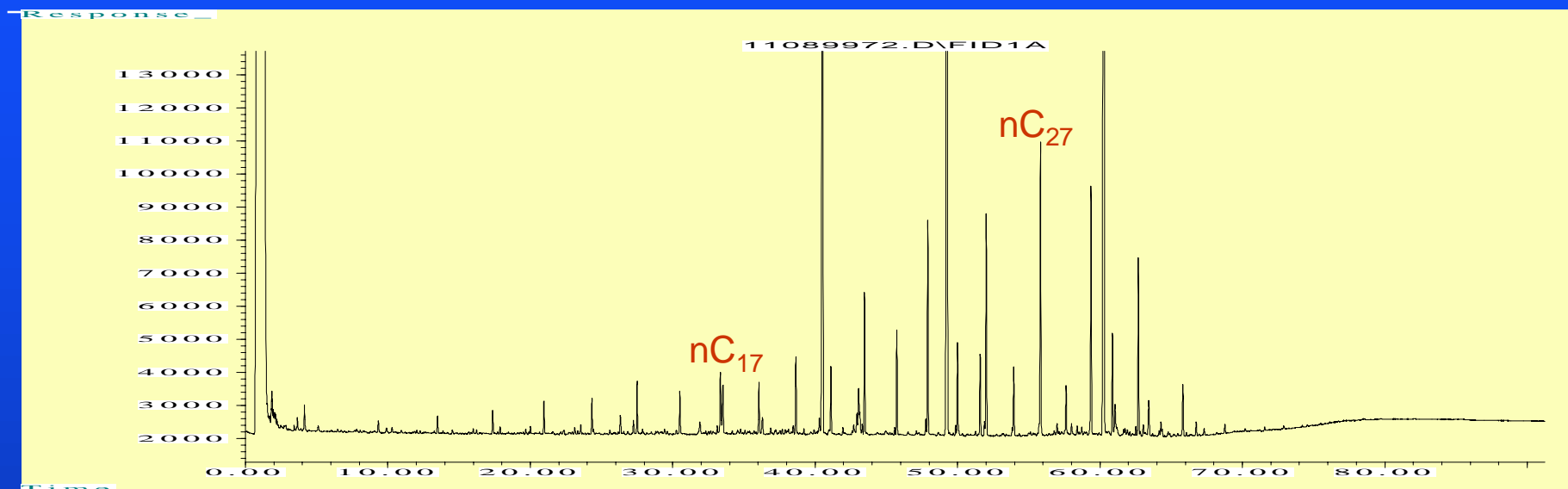
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Post-Storm

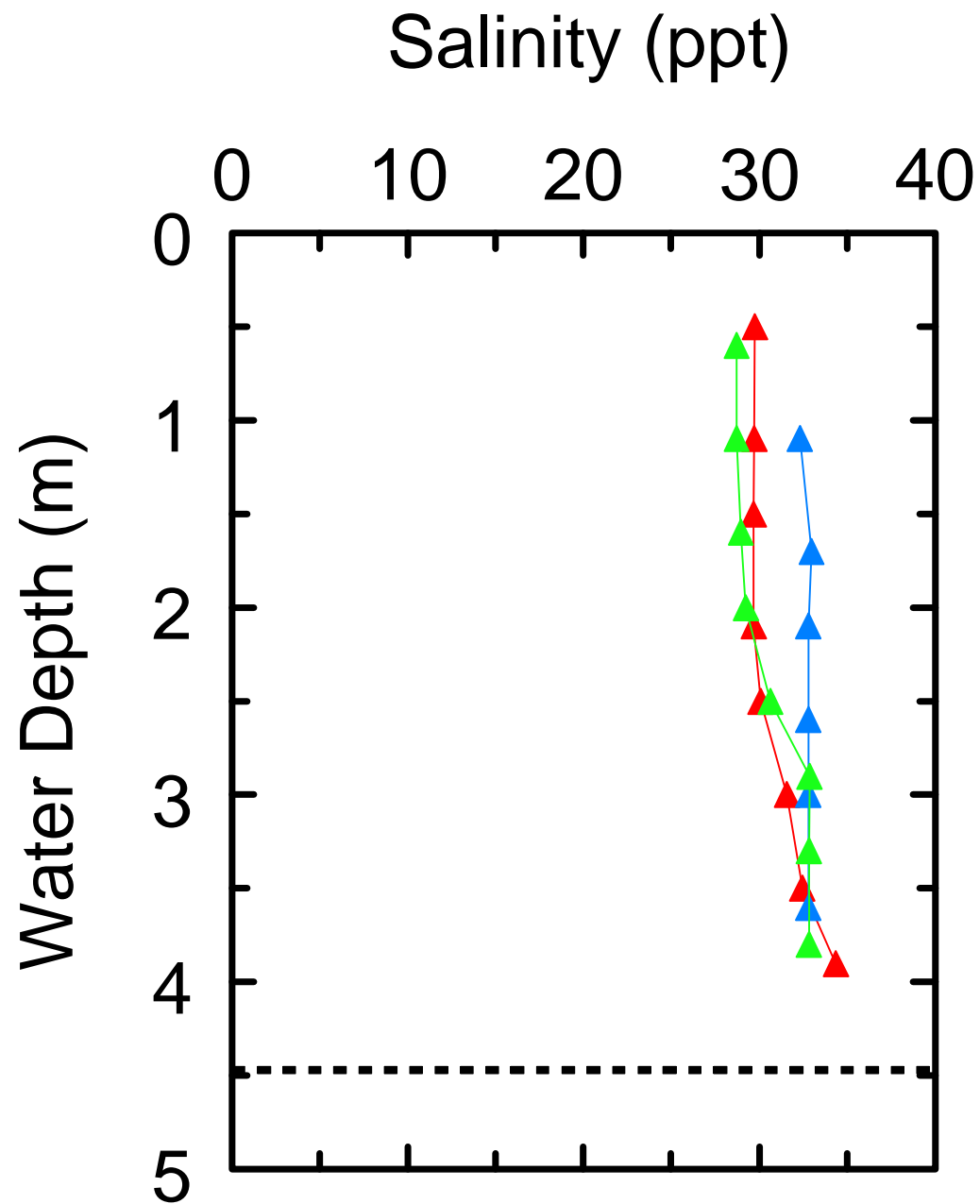
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Saturated Hydrocarbon Chromatogram and PAH Plot of Station N05 Sediment (Northstar Area)



N13



Calm, Pre-Storm

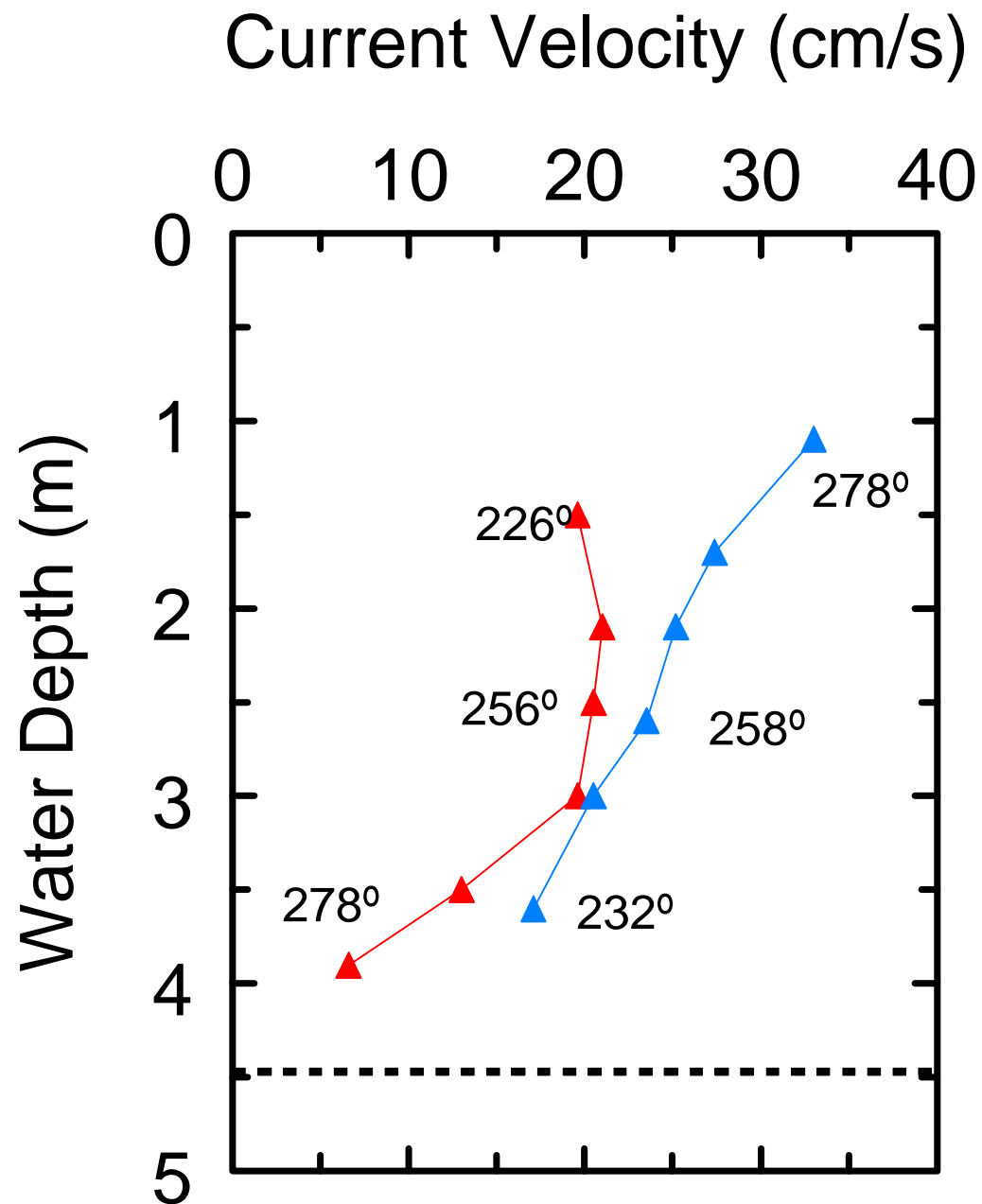
▲ 8/18/99

Post-Storm

▲ 8/25/99

▲ 8/26/99

N13



Calm, Pre-Storm

 **8/18/99**

Post-Storm

 **8/25/99**

